

The Indian Wild Buffalo, *Bubalus bubalis* (Linn.), in peninsular India: a preliminary survey

BY

J. C. DANIEL

Curator

AND

B. R. GRUBH

Research Assistant

Bombay Natural History Society

(With four maps and two plates)

CONTENTS

INTRODUCTION	..	..	..	..	..	..	32
GENERAL ACCOUNT OF THE SURVEY			..	..	..	..	33
THE WILD BUFFALO IN BASTAR AND ORISSA	..		..	..	..	..	38
FUTURE OF THE WILD BUFFALO IN PENINSULAR INDIA			..	..	..	..	48
RECOMMENDATIONS	..	..	..	..	..	..	50
ACKNOWLEDGEMENTS	..	..	..	..	..	..	52
REFERENCES	..	..	..	..	..	..	53

INTRODUCTION

The former princely State of Bastar in eastern peninsular India (now a district of Madhya Pradesh State) and the adjoining areas of Orissa and Maharashtra, by their remoteness and inaccessibility, form the last stronghold of the Indian Wild Buffalo in peninsular India. However, conditions are deteriorating even in these remote regions and the Government of Madhya Pradesh concerned at the yearly decline in the number of the Buffaloes through disease and poaching consulted the Bombay Natural History Society about the possibility of shifting, for better protection, the remaining herds in Bastar to the Kanha National Park in

Mandla District to which area Buffaloes were monsoon migrants in earlier days.

The Society, after consulting its knowledgeable members and Dr. George Schaller, the American Ecologist, who was working on a project in the Kanha Sanctuary, advised that moving the population would not be practicable considering the difficulties involved in capture and transport and the fact that the animals in their new environment would not be free from the causes of their decline in the present habitat. It was suggested to the State Government that what was required immediately was an assessment of the ecological factors of the present environment which permit continued existence in the area and the measures required to preserve these environmental conditions.

On the State Government's approval of this suggestion and offer of financial and other assistance, it was decided to survey the area in April-May 1965 when the Wild Buffalo would be restricted to areas with perennial sources of water in its habitat. Dr. Schaller, who had very kindly offered to accompany the party, was able to join us in the first fortnight of April, and the Survey was conducted in the first three weeks of April in Bastar, and in adjoining tracts of Orissa in the last week of April.

GENERAL ACCOUNT OF THE SURVEY

The Secretary to the Government of Madhya Pradesh in the Department of Agriculture and Forests had sent to the Society a list of localities in Bastar where Buffaloes are known to occur and it was arranged by the Forest Department to have us commence the survey in the Bhairamgarh Range of West Bastar Forest Division, the area believed to hold the largest concentration.

Bastar is one of the few areas in India where the railway has not penetrated, and Jagdalpur, the district headquarters and former state capital, is 180 miles by road from Raipur, the most convenient rail-head.

We reached Raipur on the evening of 1 April 1965 and after staying overnight left by road for Jagdalpur the next morning, reaching Jagdalpur in the evening of 2 April. After discussions with Dr. Schaller we met Mr. Bhil, Divisional Forest Officer, West Bastar Forest Division, where the first camp was scheduled. We left early on 3rd April for Kutru our camp for the next eight days.

Camp Kutru, April 3-11

Kutru, the headquarters of a former zamindari is a small forest village situated on the border of the Toinar and Bhairamgarh Forest Ranges of West Bastar Forest Division. These two contiguous ranges hold the major part of the population of the Buffaloes in Bastar and have

the characteristic habitat of the species in peninsular India which though river-orientated is quite different from the purely riverain and grass land habitat of the animal in eastern India (Assam), being Sal or Deciduous Forest of mixed species (in Kutru, it is only the latter) with grass undergrowth interspersed with nullahs and fairly open grounds—the maidans—with tall grass.

The main geographical feature is the beautiful Indravati River which flows through these Ranges from east to west and forms, at the western limits of Toinar Range, the north boundary of the Range before looping to the south to form the western boundary of the Range and the district.

The river is perennial and is studded with forest-covered islands and occasional patches of sparkling white sand. The Bhairamgarh Range is divided into nearly equal halves by the river. The northern half is a part of the Abujhmar Hills, the home of the hill Marias and is not a normally suitable habitat for Buffalo except along the banks of the Indravati and perhaps along the banks of the numerous tributaries which drain the hills; similarly the part of the Toinar Range on the north bank of the river. South of the river, the tract is comparatively flat with occasional hill formations and numerous nullahs and is covered with good quality mixed forests. The main road from Jagdalpur to Bhopalpatnam, the easternmost town of some importance in the district, runs parallel to the river up to Matwada in Bhairamgarh Range before turning south. From Matwada a forest road continues parallel to the river to the border of Toinar Range and, turning south at Pasewada, continues parallel to the river before turning east to rejoin the west road at Kutru. The west road from Matwada to Pasewada forms the south boundary of the summer range of the buffalo. The distance between the road and the river varies from approximately four to ten miles.

The camp at Kutru was located in an ancient grove of mango trees facing a large pond covered with water lilies, among which Bronzewinged Jaçanas (*Metopidius indicus*) and a large flock of Lesser Whistling Teal (*Dendrocygna javanica*) scrambled for food during the day. The location of the camp in the middle of the summer range, a survey area of approximately 400 square miles of forest between the river and the road, was advantageous. From discussions with the Forest staff we gathered that the Buffaloes, though now confined to the river, would not be as easy to locate as they are when they occupy less remote localities in the monsoon and in the winter. In view of the short time available to us it was decided to transect areas which, according to local information, Buffaloes frequent and where they had been seen recently. Seven such transects were made between 4 to 11 April covering the whole strip of forest north of the road between Matwada and Pasewada. South of the road, Tekametta Reserve Forest on the east bank of the river in Toinar Range and Gudma Reserve Forest south of Kutru were also visited.

Comments on the Transects

During the seven transects that we made in the area (see Table I) we were able to sample a substantial portion of the Buffalo habitat (Map I) and could form an opinion on the status of the Buffalo in the area. It was evident that very little was known of the distribution of the animal in summer¹. Some of the areas visited by us were selected on the

TABLE I
TRANSECT DATA OF THE THREE WILD BUFFALO AREAS SURVEYED

Transect No.	Date	Route	Approximate distance walked (miles)	Buffalo tracks seen :			Buffaloes seen
				solitary	approximate herd strength	total	
WEST BASTAR							
I	4 April	Pathakutru-Berabasti-Kutru	10-12	2	—	2	10
II	5 April	Jegur-Indwada-Dodum-Jegur	12-14	2	12	14	—
III	6 April	Matwada-Ider-Matwada	12-14	3	16 (10, 6)	19	—
IV	7 April	Gudma Reserve Forest	5-6	1	—	1	—
V	8 April	Museli-Bitre-Karkeli-Karpe-Madhpur-Dudapalli	12-14	2	12 (4, 8)	14	—
VI	9 April	Karkewada-Nelkakler-Pengonda-Pasewada	10-12	5	5	10	—
VII	10 April	Tekametta-Jarguda-Tekametta	4-5	—	—	—	16
				15	45	60	26
SOUTH BASTAR							
I	15 April	Pamed-Koragatta border	10-12	1	10	11	—
II	16 April	Rampuram-Pusgupa-Dharamvaram-Rampuram	12-14	—	—	—	—
ORISSA							
I	26 April	Chitrakonta-Kondakamberu-Bandamamidi-Chitrakonta	5-6	—	3	3	3

NOTE. Tracks probably did not exceed 24 hrs. in age.

¹ The seasons as described in this report are Summer—(March to May) ; Monsoon—(June to October) ; Winter—(November to February).

strength of local information based on sightings during the rains and in winter when the animals are found in a large area as water and food are easily available. In summer the Buffalo is restricted to the narrow strip between the river and the road from Matwada to Pasewada, frequenting areas undisturbed by man, with good cover and water, out of which it ventures at night to feed on the tender new grass and bamboo shoots growing in burnt areas. During the seven days we walked through the forest we saw only two herds. In the same period we saw 30 Chital, 2 Nilgai, and 7 Fourhorned Antelopes and, from our observations of the herds we saw, it did not appear to us that Buffalo is in any way shyer than these species. However large mammals are scarce in West Bastar, and apart from those listed above we twice saw fresh tracks of gaur and tiger.

April 11 to April 14

After breaking camp at Kutru on April 11 we reached Pujarikaker in Awapalli Range in the south of West Bastar Forest Division on the evening of 14 April.

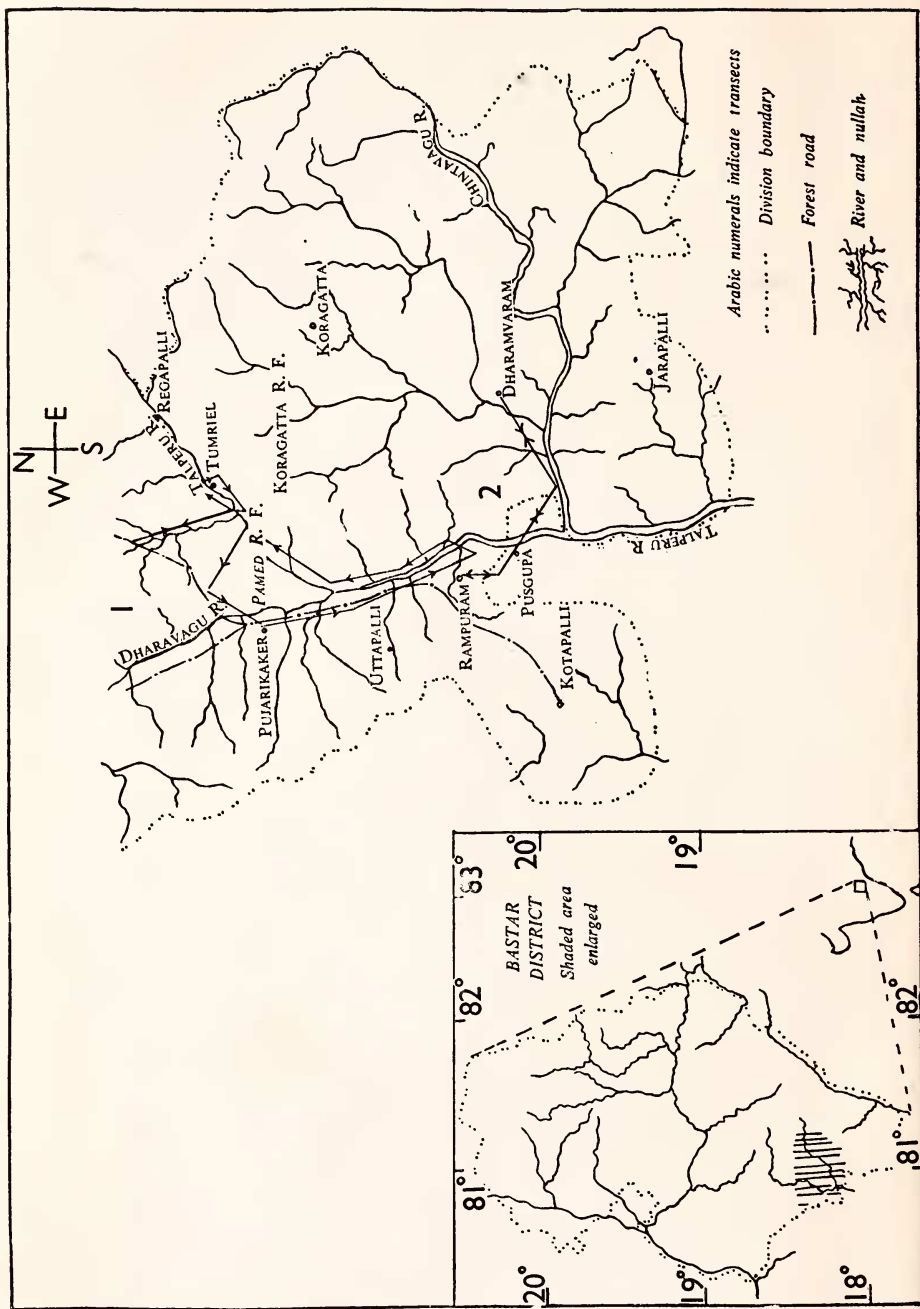
Awapalli Range, West Bastar Forest Division, April 14-17

The Pamed and Koragatta Reserve Forests of Awapalli Range and the adjoining Konta and Kistaram Range Forests of South Bastar Forest Division hold the southern population of the Buffalo in Bastar. The Awapalli Range lies in the riverain tract of South Bastar, separated in the east from the Warangal District of Andhra Pradesh by the Albaka Hills. The main river is the Talperu, a perennial stream arising at nearly 4000 ft. on the Bailadila Ridge and draining the west face of Bailadila Hills, the east face of Albaka Hills, and Golapalli Hills in the south-east by its tributaries before joining the Godavari River near Cherla in Andhra. The Talperu forms the south and west boundaries of Pamed and its tributaries Dharavagu and Kongavagu a part of its east and west boundaries. The larger Koragatta Reserve has the Talperu as its east and north boundaries and a main tributary, the Chintavagu, as a part of its south boundary. In the west the Reserve has a common boundary with the Konta and Kistaram Ranges of South Bastar Forest Division. The Koragatta Reserve is uninhabited except along its borders and is not usually visited by Forest personnel as the forest is not worked. The forests in both reserves are drier than the habitat in the west and the whole area is deficient in water. The Talperu River remains the main source of water in summer and the Buffaloes remain mainly in Koragatta during the season.

We made two transects (Table I and Map II) in the area, one covering Pamed and the Pamed-Koragatta border and the second the south border of Koragatta Reserve. We were unable to penetrate Koragatta Reserve owing to lack of roads and persons with knowledge of trails in the area.

Map 1. Transects in west Bastar

Daniel: Indian Wild Buffalo



Comments on Transects

The two transects we made gave us an indication of the conditions in the habitat in the south. In the Pamed Reserve the grass undergrowth was either burnt or grazed to the roots by large itinerant herds of Banjara¹ cattle, several herds of which were passing through the Pamed area at the time of our visit and in the disturbance from their movement wild life had shifted to the west bank of the Talperu into the Koragatta Reserve. The local villagers believed that there were only a herd of 10 to 11 animals and 2 to 3 solitaires in their area, an opinion which agrees more or less with the track counts we made (see Table I). The Koragatta Reserve, particularly to its north, appears to be the summer sanctuary of the herds but no one appears to have personal information. South of Koragatta and Pamed, the country towards Andhra Pradesh is more populous and dry and is overgrazed so that it is most unlikely that Buffaloes now occur in Andhra Pradesh.

South Bastar, April 17-22

On completing the survey of the Awapalli Range we had planned to shift camp by the shortest route through Cherla and Dumagudem in Andhra Pradesh to Golapalli in South Bastar Division. Unfortunately the car developed engine trouble and it was not considered wise to take it over the road to Cherla which was in poor condition. Another two days were lost in the return to Jagdalpur, in arranging for another vehicle, and in the journey to Konta in south Bastar on 19 April. The road to the south runs through beautiful sal forests at the beginning but turns to dry deciduous further south, becoming very dry near Konta. We saw two large parties of Gonds on *Parad*, their communal hunt, during the journey. We stayed overnight at Konta and a pleasant hour's drive the next morning over low forest-covered hills brought us to the village of Golapalli, the headquarters of the Golapalli and Kistaram Ranges of the South Bastar Forest Division. In discussions with the Range Officers of Kistaram and Golapalli we learnt that Buffaloes are not seen in their Ranges in summer, when there is considerable difficulty for water and large herds of cattle from Andhra are permitted to graze in the forests. In their opinion Buffaloes do not occur south of Potakpalli village 15 miles north of Kistaram village even in the rains but frequent the extreme north of Kistaram Range in the vicinity of Elmagonda and Kolaiguda villages adjoining Koragatta Reserve of Awapalli Range, W. Bastar. The Range Officer, Kistaram, had seen a herd of 15 to 17 animals between Elmagonda and Kolaiguda villages in 1963, and in March 1965 a solitary bull was seen on the road from Elmagonda to Potakpalli. A visit to

¹ Banjaras, once indispensable as carriers and used as such by all the armies which campaigned in the Deccan and central India, are now mainly cattle traders.

Elmagonda area 25 miles north of Golapalli proved fruitless. We started back for Jagdalpur from Golapalli on 22 April, reaching Jagdalpur the same evening. Transport was not available to visit the Paralkote and Makdi areas in north Bastar which had been listed by the State Government as holding Buffaloes. It was a great disappointment to us that we were unable to survey these areas.

Orissa, April 24-27

On 23 April, while we were still uncertain whether transport would be available to us to visit north Bastar, we received a letter from Mr. Ahmedulla, Conservator, Jeypore Circle, inviting us to visit Buffalo habitats in his Circle.

We reached Jeypore on the 24th morning and arrived the same evening at Chitrakonta in the valley of Kondakamberu, the main habitat of the Buffalo.

Kondakamberu used to be a forsaken little Police Outpost with a few attendant huts in a high and narrow valley of the Jeypore Hills in the Koraput District of Orissa. Through the valley, surrounded on all sides by hills covered with dense forest, flows River Sileru towards its junction with Sabri River below Konta. A remote, wild, and inaccessible valley, scantily populated by tribal people related to the Gonds of Bastar, it is the last sanctuary of the remnants of herds of Buffalo which once inhabited the riverain tracts of the Sileru and the Sabri. Where the Buffaloes once roamed freely giant machines rip up the earth shattering the silence and hordes of people roam the jungles. Across the valley an earthen dam is rising in all its raw-earth ugliness to hold the waters of the Sileru to feed the turbines of a hydro-electric project being constructed jointly by the Governments of Orissa and Andhra with Russian technical assistance. Once the dam is completed the present Buffalo habitat in the valley will be under hundreds of feet of water and the Buffaloes driven to the hill slopes or to the few smaller valleys protected by dykes.

In the very short time available to us it was possible to obtain some information (Table I) on Buffaloes and to visit Buffalo habitats. The whole area was considerably disturbed and according to local information most of the Buffaloes had moved to the secluded and undisturbed areas of the valley. We returned to Jagdalpur on 27 April and after assuring ourselves that no transport was available for north Bastar terminated the survey.

THE WILD BUFFALO IN BASTAR AND ORISSA

The literature on the Buffalo is limited to occasional observations on habits published by hunters in the records of their hunts and notes on the species, mainly based on these observations, published in standard

Daniel : Indian Wild Buffalo



Above : Indravati River, West Bastar. Below : Wild Buffalo wallow in mixed forest, West Bastar

(Photos : George Schaller)

Daniel : Indian Wild Buffalo



Above : Wild Buffalo in Kaziranga Sanctuary, Assam. Below : Solitary Wild Buffalo bull in Kaziranga Sanctuary, Assam

Note difference between the habitats—Bastar (Plate I) and Assam (Plate II)

(Photos : E. P. Gee)

works on Indian fauna. Where relevant these have been correlated with our observations. We have also included information on the distribution and status of the Buffalo in eastern India to present as complete an account as possible of the present position of the animal.

The Animal

The Wild Buffalo is a magnificent large and streamlined version of the domestic animal, attaining a height of 5 ft. 4 in. at the shoulder and a weight of over 2000 lb. The horns are massive and average over 3 ft. in length. None of the domestic breeds equals the wild animal in size and weight except perhaps the Hissar, but there is no comparison with the lithe alertness that freedom has bred into the wild animal.

Distribution and Status

HISTORICAL

The distribution of the Wild Buffalo was associated with the large rivers and their tributaries in the Gangetic Plain and eastern and eastern-peninsular India, extending from the riverain grass jungles of the Rohilkhand Terai to Assam in the east and the Godavari in the south-east, within historic times (Map III).

In the first and second quarters of the nineteenth century, the Wild Buffalo was abundant and reportedly seen in hundreds along the great rivers of eastern India, particularly in the marshes, jheels, and extensive riverain coverts which occurred at that period in the districts of Purnea (Bihar), Malda, Dinajpur, Jalpaiguri, Dacca, Fareedpur, Noakhali, and the maritime tracts of Midnapore of undivided Bengal, and the churs of the Brahmaputra and the plains of Assam.

In peninsular India they were equally abundant in the maritime tracts of Balasore and Cuttack in Orissa and the plains of south-eastern Madhya Pradesh in the districts of Mandla, Raipur, Sambalpur, and Bastar with a west boundary approximately coinciding with the 80° longitude and the Pranhitta River and as the south boundary the north bank of the Godavari River.

The settlement of these areas and consequent clearing of the habitat for cultivation, combined with large scale hunting and loss through disease, have wiped out the population over a large area of its general distribution and restricted the animal to the protection of sanctuaries or the inaccessibility of the habitat.

Present Distribution

EASTERN INDIA AND NEPAL

The Wild Buffalo is now extinct in the Terai of U.P., Bihar and Bengal, and the maritime tracts of Midnapore (Bengal) and Balasore and Cuttack

(Orissa). In Assam it is seen only in the sanctuaries of Manas, Kaziranga, Pabha, Laokhowa ; in the Sankos-Manas riverain tract, and in Lakhimpur. A few herds are also found in the Kosi River area of Nepal, in the most inaccessible portions of the flood plains east and west of the river some 20 to 30 miles upstream from the Kosi River Barrage near the International border (Willan : pers. communication).

PENINSULAR INDIA

In the range of the species in eastern peninsular India, mentioned earlier, we have personal knowledge of their occurrence only in west and south Bastar and the Koraput District of Orissa. They are reported to occur also in north Bastar and south Raipur districts in Madhya Pradesh, and east Chanda in Chanda District, Maharashtra. There are possibly a few animals in the upper reaches of the Jonk River in Orissa, where they used to be abundant in earlier days. As suggested by Mooney (1930), these animals are perhaps shared with south Raipur. We are also informed that a few buffalo may still persist on Gamdhamardhan Hill between Patnagarh and Nawapata in Orissa.

One of the specific questions that we planned to study during the survey was the distributional limits of the different populations. We were able to obtain a fairly comprehensive idea of the distribution in west and south Bastar.

Bastar (Map IV)

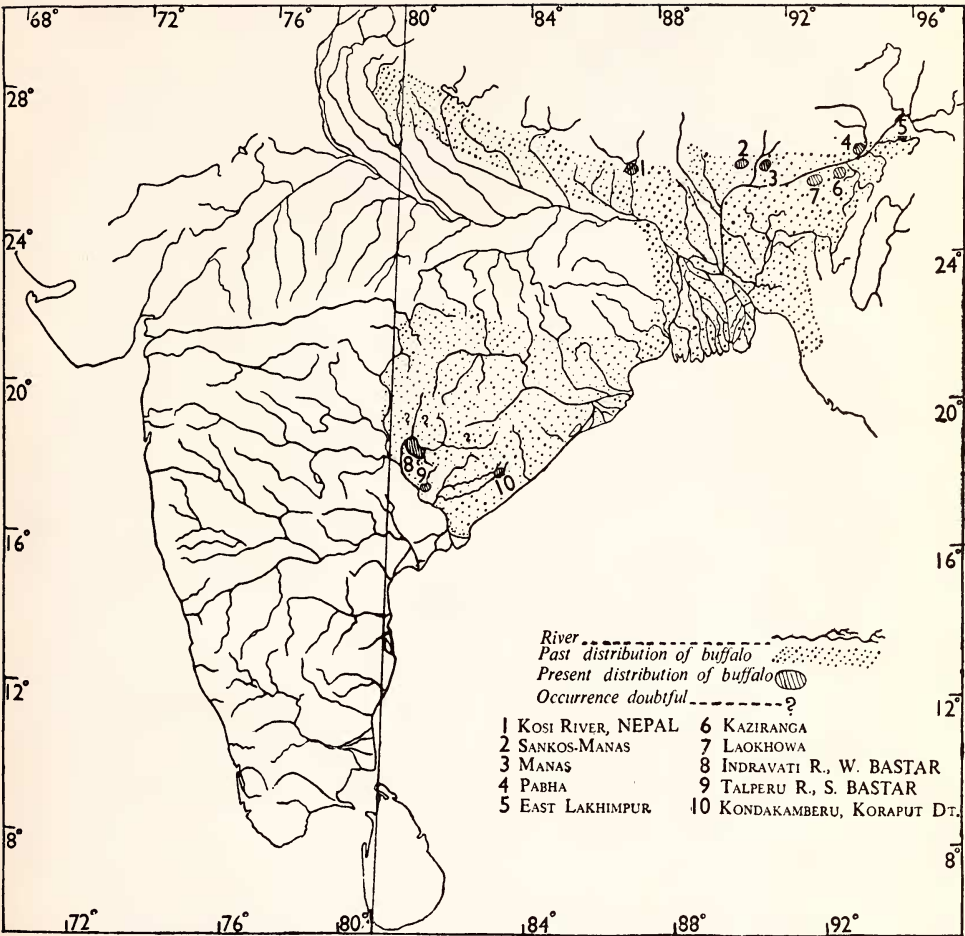
The range of the species is so dependent on the availability of water at different times of the year that it is not difficult to define the larger monsoon and winter range, associated with easy availability of water, and the restricted summer range, limited to areas with perennial water.

West Bastar

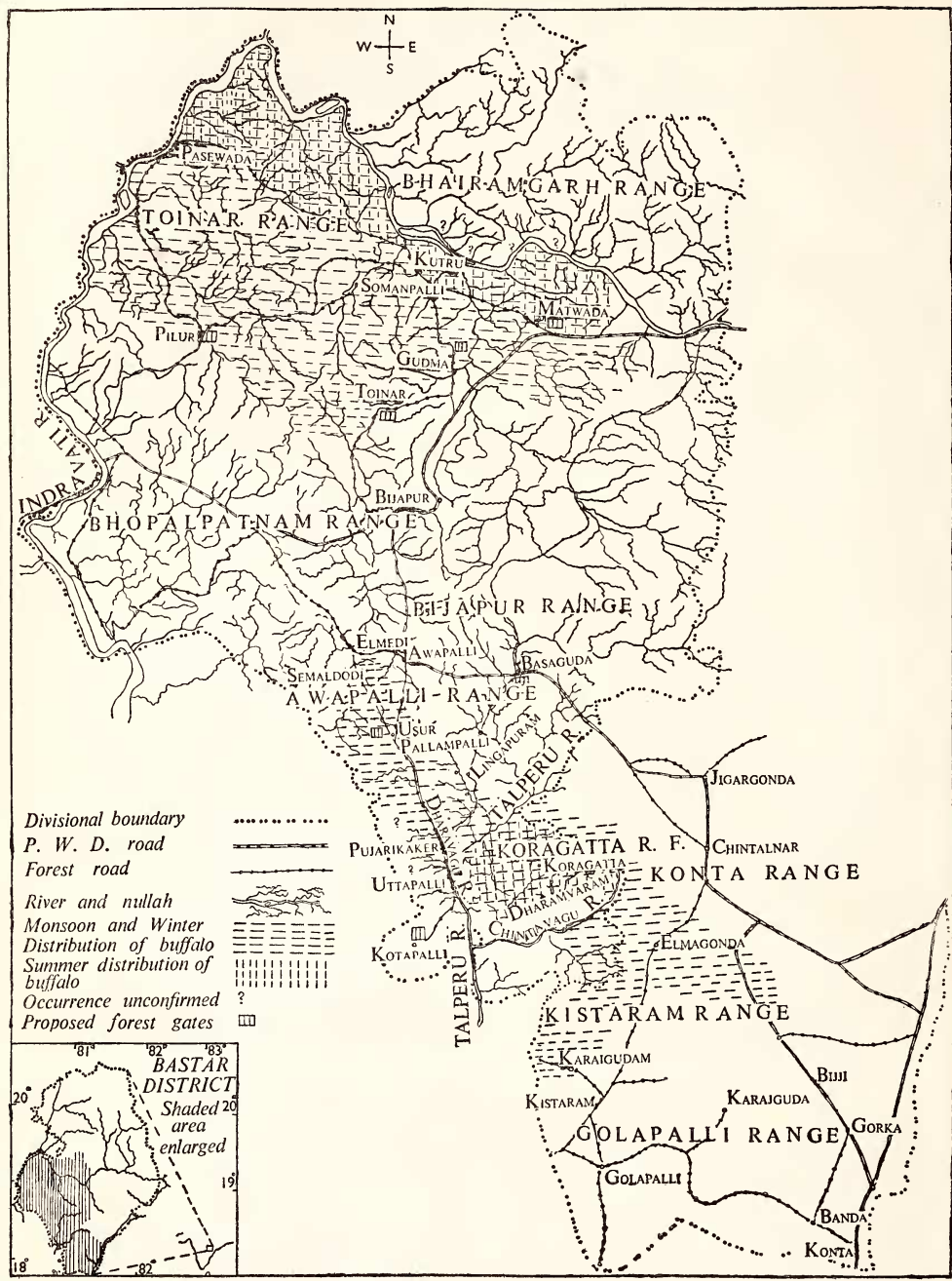
We refer here only to the Toinar and Bhairamgarh Ranges of West Bastar Forest Division. The Awapalli Range of the same Division adjoins Buffalo areas in south Bastar and is considered along with them in the distribution of the Buffalo in south Bastar.

Monsoon and Winter. In the Toinar Range, from the south bank of the Indravati River to Toinar Forest in the south-east and Mingachel (Berudi River) in the west. It is likely that they are seen throughout the Bhairamgarh Reserve Forest south of the Indravati in these seasons. The marginal limits are tentative and perhaps animals wander further south in forest areas. Solitary animals have a larger range.

S u m m e r. In summer the Buffalo is restricted to the banks of the Indravati River and to the forests on its south bank bounded on the



Map 3. Past and present distribution of the Wild Buffalo in the Indian Region



Map 4. Distribution of the Wild Buffalo in west and south Bastar

south by the forest road running from Matwada in the east to Pasewada in the west. Along the river they occur up to Tekametta and perhaps further south where suitable cover is available. Solitaries may wander to areas south of the road.

South Bastar

Monsoon and Winter. In the Awapalli Range of West Bastar Forest Division, they range from the Koragatta Reserve Forest in the south to Usur Reserve Forest and Semaldodi in the north moving north along the Dharavagu River from their summer range. In the Kistaram Range of South Bastar Forest Division they occur up to Kolaiguda in the east and Potakpalli in the south. Solitaries are said to reach up to Bijji village in Konta Range, South Bastar Forest Division.

Summer. Koragatta Reserve Forest in Awapalli Range, solitaries occasionally in Pamed Reserve and north Kistaram.

The two populations in west and south Bastar are now isolated, though there is the possibility of intermingling through solitaries during the maximum distribution in the monsoon and early winter. This is perhaps uncommon in view of the extensive cultivated areas between the ranges of the two populations.

Orissa

Buffalo occur in only a very restricted area in the Koraput District in the upper reaches of Sileru River. Our stay in the area was too short for us to get an idea of the range. The valley they inhabit will be submerged. We were informed of some herds in the Maheswarapur area near Balimela at the foot of the hills adjoining the Kondakamberu valley. Buffaloes are said to have been found near Orkel on the Potteru River west of the Sileru.

Habitat

Bastar

We have information only on the habitat in west and south Bastar. The Sal forest in the north, where also they are said to occur, was not visited. In the west and south they inhabit tropical dry deciduous forests associated with the two major rivers of the region, the Indravati in the west and the Talperu in the south. The forests, classified as mixed forests, have several species of trees of almost equal importance. The forest canopy is 40 to 60 ft. high and the growth is spaced and not so dense, the canopy being 40-50% when in leaf. Most of the dominant species are deciduous, some of the important constituents being *Diospyros melanoxylon*, *Terminalia tomentosa*, *Anogeissus latifolia*, *Lagerstroemia*

parviflora, *Buchanania latifolia*, *Madhuca indica*, *Stereospermum suaveolens*, *Tectona grandis*, *Pterocarpus* sp., *Gmelina arborea*, and *Butea monosperma*, near villages. Bamboo (*Dendrocalamus strictus*) occurs on hill slopes and river banks. Grass is the dominant undergrowth and grows luxuriantly in forests ungrazed by domestic stock, and in clear-felled areas the sites of abandoned cultivation, which are a common feature in the forests near the Indravati River. Dominant species of grass are *Imperata cylindrica*, *Eulaliopsis binata*, *Heteropogon contortus*. Almost pure stands of the Chind palm *Phoenix acaulis* form the undergrowth in rocky areas. Saplings and shrubs are found as undergrowth only in hill features.

The grass cover is a good 3 feet in height in areas not grazed by domestic stock, but progressively deteriorates in quantity and quality in settled areas with large domestic stock. Around villages it is close-cropped and lawn-like with only Mohwa trees (*Madhuca indica*) left of the original forest cover, giving an indication of how the country will appear with increased human population, and the clearing of forests.

A similar type of forest occurs in the south but it is drier, particularly south of Talperu. It is heavily grazed by cattle and is subject to other human interference.

In the summer when we visited the area almost all the deciduous trees were leafless and the undergrowth of grass had been fired by the villagers to facilitate the collection of mohwa flowers. If some of the forest fires we saw are an indication, uncontrolled forest fires must be doing considerable damage. In April summer showers were commencing and new grass had started to grow on burnt areas. The river in its shallow sections had a good growth of sedge and a grass-like tuberous plant said to be favoured by Buffalo. Most of the nullahs were dry or had water only near their junction with the river. Wallows within the forest had dried. Food and water resources were thus at a minimum.

Orissa

The only habitat seen in Orissa was the Kondakamberu valley. The forest here also is of mixed species but growth is denser and the canopy higher than in Bastar. The river bed held sedges similar to those in Bastar and the undergrowth was predominantly grass.

Population

Very large herds, estimated at 75 to 100 animals, were noted formerly throughout the then distributional range of the Buffalo. It seems unlikely that these estimates are based on actual counts but it is evident that the Buffalo was extremely abundant.

The present population, in keeping with the reduced distribution, is

but a fraction of its earlier abundance. During the surveys we had track counts and actual sightings as listed below :

		SOLITARY	HERD	TOTAL
West Bastar	..	15	71	86
South Bastar	..	1	10	11
Orissa	..	—	8	8
				<hr/> 105 <hr/>

West Bastar

Considering the fact that in west Bastar we have the largest and best Buffalo habitat now available in peninsular India, an area of about 400 sq. miles, the population is astonishingly low. We do not believe that there are more than 200 to 250 animals in the area, and some among these are shared with the adjoining Chanda District of Maharashtra. The actual count is about half the lower estimate but we are taking into account herds we were told of and did not see and areas which we did not have the opportunity or the time to visit. Information gathered from Forest Department personnel and villagers independently more or less tallies with our figure. The population was estimated at 75 to 100 and 50 to 100 respectively in South Bhairamgarh Range which area is said to have the largest concentration.

We often heard in Bastar of the numbers seen during the rains and in winter, but it must be noted that at these seasons the Buffalo wanders considerably and there is every possibility that a herd may be reported from two or three places.

South Bastar

We hesitate to give an estimate of the population as the Koragatta Reserve was not surveyed but, from the evidence we have, an estimate of 50 may be excessive.

Orissa

Our period of stay was not of sufficient length to make an assessment of the population, but Mr. Ahmedulla, the Conservator of Forests, Jeypore Circle, thinks there are about 100 animals in his Circle mainly concentrated in the Kondakamberu valley and Maheswarpur near Balimela.

General

We do not think that the total population throughout the present distributional range in peninsular India would exceed 400 to 500 animals.

Mr. E. P. Gee very kindly gave us the figures of his estimate of the population in eastern India and Nepal and these are quoted below to give an idea of the total population of the species :

ASSAM

Manas Sanctuary	..	400
Kaziranga Sanctuary	..	700
Pabha Sanctuary	..	100
Laokhowa	..	50
Sankos-Manas	..	75
East Lakhimpur	..	100

Total .. 1425

NEPAL

Kosi River	..	15-20*
------------	----	--------

*Approximately 100 (Willan : pers. comm.).

Dr. Schaller who spent six days in the first week of May in Kaziranga Sanctuary has sent us data gathered during his stay. In his visits to a major portion of the Sanctuary he counted herds of 3, 7, 8, 18, 18, 17, and 20 and 4 solitary bulls. He received the impression that Mr. Gee's estimate of the population in Kaziranga Sanctuary is rather high.

It should be noted that the total population of the species throughout its range does not exceed 2000. This fact needs the serious consideration of conservationists.

Breeding

The 15 calves of less than six months of age seen in Bastar and at Kaziranga (see Table II on Herd Composition) suggest that the main

TABLE II
HERD COMPOSITION

Date	Location	Adult bulls	Adult cows	Sub-adult and yearling bulls	Sub-adult and yearling cows	Young:		Total	Source
						0-6 months	6-12 months		
10 April	Indravati River, west Bastar	—	6	1	2	5	2	16	Daniel and Schaller
26 April	Kondakamberu, Koraput Dt., Orissa	—	3	—	2	—	—	5	Daniel
May	Kaziranga Sanctuary, Assam	1	4	1	—	1	1	8	Schaller
	do.	—	7	—	2	5	—	14	do.
	do.	—	8	2	4	2	—	16	do.
	do.	—	10	2	4	2	—	18	do.

period of rut is apparently not confined to the autumn as stated in literature but is spread over a period of at least five months, and perhaps longer, with a peak of conceptions occurring during the first half of the year.

Solitary Bulls

Several opinions have been expressed in literature regarding the reasons which make many bulls lead a solitary existence. It has been suggested that solitary bulls are dispossessed master bulls of herds and also that solitary animals become so of their own accord. In the opinion of Dr. Schaller, based on his observations on the Gaur (*Bos gaurus*) in Kanha and the Buffalo in Bastar and Kaziranga, it is apparent that mature bulls are solitary and associate with a herd only periodically. Fights may occur when two bulls happen on a herd holding a cow in season, the stronger bull keeping with the herd and driving off later arrivals. It is significant that of the six herds of which we have composition data only one had an adult bull. In summer at least bulls are seldom seen with herds. Bulls wander considerably and at times remain in summer in areas in which herds are now seldom or never seen.

Daily activity and food

We could obtain very little information on the daily activity of the animal and there is little published information. In undisturbed areas they are said to feed in the open at dusk and dawn, retreating into cover or to their wallows during the intervening period. In Bastar they are said to frequent forests near cultivation where crops, particularly rice, are grown. In the herd we saw in the early morning at Bastar some were feeding on the sedge *Cyperus corymbosus* growing on the river bed and some lying in the water. Some of the animals were rather thin.

The Buffalo is considered a selective feeder, wandering long distances in the course of grazing. The only grass that has been so far identified as a food of the species is the Dub, *Cynodon dactylon*, a perennial creeping grass found throughout India—one of the commonest and most useful species and about the only species that remains green in hot weather. Among the grasses collected by us the following species *Themeda quadrivalvis* and *Coix* sp. were identified by local villagers as eaten by Buffalo.

Predators

Other than man the tiger is the only predator capable of killing adult animals and instances of kills relate mainly to calves and sub-adults. Inverarity (1895) records seeing the remains of a calf of about 18 months and also seeing an old bull with teeth and claw marks on the rump.

The only evidence we had in Bastar of death through natural predators was the remains we saw of a calf during the fifth transect in West Bastar. The kill, probably a tiger's, was some 3 to 4 months old and bones, teeth, and hair were collected. In Orissa we had reliable information on the killing of a sub-adult female by a tiger near Kondakamberu. This animal had an infection on its head and was living in the forest near a village. Schaller was informed that tigers occasionally kill adults in Kaziranga.

Relation to Man

In its relation to man lie the reasons for the decline of the Buffalo, as the ideal Buffalo habitats in the riverain regions of the Gangetic Plain and eastern and peninsular India have been mostly reclaimed for cultivation. Curiously enough, in Bastar, though man's activities have been in the main inimical, his methods of cultivation have partly contributed to the utilization of its habitat by the Buffalo. Bastar has remained as one of the few regions in Madhya Pradesh where the original Gond inhabitants have retained their tribal organization and practices. In the Indravati area of Bhairamgarh and Toinar Ranges settled by Hill and Dorla Marias respectively shifting cultivation is still practised. Flat land covered with forest is clear-felled and fired for cultivation and after two to three years of use is abandoned for twelve to fourteen years. There are several such abandoned clearings and their adjoining villages in the two Ranges in various stages of forest regeneration. These sites, because of the forage available, are much frequented by buffaloes.

These indirect benefits are offset by other human activities, particularly the killing of animals in the large scale communal hunts (*Parads*) and in the protection of crops.

Domestic Stock and the Buffalo

In west Bastar the forest villages in the summer range of the species in the Bhairamgarh and Toinar Forest Ranges have very few cattle and the forest, except in the vicinity of the villages, shows little effect of grazing. The village of Karkewada had the largest number of cattle, approximately 200 to 300 head.

In south Bastar very large herds are grazed in the monsoon and winter range, and in part of the summer range in the summer months when the availability of food is at a minimum. Most of these cattle are brought into Bastar from Andhra Pradesh. In addition, large herds of Banjara cattle move through the area. The conditions within the Koragatta Reserve are not known to us, but outside this fresh grass is hard to come

by. There is, thus considerable pressure on food resources which would affect the chances of survival of the few animals still existing in the south.

Domestic buffaloes are uncommon in the forest villages of the Indravati tract, though seen quite often in the settled area to the east and south. The horns of the domestic buffalo in Bastar often showed a distinctive resemblance in shape to those of the wild animal. In the more populated south, domestic buffaloes are kept by villagers living near the Buffalo habitat.

The wild and tame animals being so little differentiated, interbreeding occurs through solitary wild bulls appropriating domestic herds. The result of a crossing with a wild bull is not usually successful. The wild cross calf being large often causes the death of the mother at delivery and 75% of the calves also die at birth or within 8 days, owing, it is believed, to insufficiency of milk. Chances of survival however increase with the second generation (Gee 1953, Lall 1953). These reports refer to the situation in Assam, where owners of domestic stock strongly dislike for these reasons the mating of their animals with wild stock.

We did not receive similar reports in Bastar where apparently crossing with wild bulls is not disliked. According to Noronha (1954) the buffaloes of the village of Bijji in Konta Range, south Bastar, are three-quarters wild and mating with wild bulls is encouraged. In the one case investigated by us in Dharamvaram village in south Bastar, we were informed that a solitary bull had visited the village from August to December for three consecutive years, spending the night with the herd and leaving in the morning. Three cow buffaloes had conceived but all had aborted after four months. The suggestion that the animals had been deliberately aborted in view of the belief that cows mated to wild bulls die at delivery was vigorously denied.

Disease

Contagious diseases spread by domestic animals have been one of the main reasons for the disappearance of the Wild Buffalo in peninsular India. In the 1920's, Stewart (1927) and Stockley (1928) noted that Rinderpest had almost wiped out the Buffalo in the Central Provinces (Madhya Pradesh).

We were informed by the Range Officer, Kistaram Range, that there was a severe attack of Rinderpest in the Golapalli Reserve Forest in the cold weather of 1963-64, when several sambar and chital were found dead. He had no information on the situation among the Buffaloes which occur further north in areas rarely visited by Forest personnel. Sporadic attacks of Rinderpest are not uncommon in Bastar, a main cause being the large herds of Banjara cattle driven through the district